Hearing conservation campaigns for adolescents: visibility and effects reported by university students

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1 Introduction

Leisure time sound exposure is nowadays regarded as a potential threat for hearing health [13]. Excessive music exposure might as such be linked to noise-induced hearing damage (NIHL). In this regard, adolescents are a particular vulnerable group, often frequenting entertainment venues [7] and listening personal music players [11, 8].

The first step in hierarchic risk control would be an overall reduction of leisure time exposure levels [1]. In the last years, the Flemish government has taken action by imposing exposure limits for electronically amplified music at events and venues [2]. However essential, this kind of legislation does not fully control the noise dose at an individual level. People can still accumulate noise exposure, for instance by consecutively visiting different events or by listening to their personal music players at elevated levels [12].

Health promotion and eduction have in principle the potential to raise awareness of the link between noise exposure and hearing damage, and to motivate adolescents to act accordingly [7]. Positive effects are seen in focused interventions where children/teenagers are directly addressed in smaller groups [4], although other researchers are more skeptical [12]. Nevertheless, also after broader information campaigns, for instance at a regional level, more negative attitudes towards noise are reported, as well as the reported (intention to) use hearing protectors [5].

However, the positive effects are rarely seen for all domains necessary for successful hearing conservation [12]. In addition, changes do not always persist over longer time periods, especially when an 'older' teenage/adolescent population is addressed. Furthermore, broader campaigns might go by unnoticed by the targeted population.

In the Flemish part of Belgium, considerable resources have been spend on campaigns to promote safe leisure time noise exposure, especially since the design of the legislation for electronically amplified music levels around 2011. Various campaigns have been launched for the whole Flemish region, per province, and also by health insurance organizations. Those campaigns all provide on-line information on risk of excessive noise exposure and preventive measures. Some add extra features such as a self-test for risk assessment and/or application for sound level measurement. In addition, most of the campaigns also provide classroom material.

The young adults now starting university (on average between 17 and 19 years old) belong to the target audience of hearing health campaigns. The current study aims to investigate whether beneficial effects on hearing conservation can be seen. Three major questions are addressed (1) the visibility of the campaigns among young adults, (2) the factional knowledge of adolescents in preventing NIHL, and (3) their reported behavior with respect to hearing conservation.

2 Methodology

2.1 Questionnaire

The data presented in this paper are selected from a larger survey addressing attitudes and knowledge of adolescents with respect to music exposure, hearing loss, and hearing protection. The content of the questionnaire has been based on existing examples in literature [9, 3].

To assess whether the participants are familiar with recent campaigns on leisure time noise exposure, the logos of seven campaigns are depicted. Participants are asked to mark all campaigns they have heard of, and they are invited add any extra campaign themselves.

Subsequently, nine multiple choice questions are asked, addressing factual knowledge on hearing damage and hearing protection. The questions are based on the tips and tricks to avoid noise-induced hearing loss given in the different campaigns. For each question, four possible answers are given with one correct.

Finally, a list of six possible measures to prevent noise-induced hearing loss is given: wearing hearing protectors, taking breaks in a more quiet environment, monitoring the environmental noise level, moving away from the loudspeakers, avoiding places where loud music is played, and lowering the level of the personal music player. On a ten point-scale between the extremes ‘never’ and ‘always’ participant have to indicate how often they apply those measures. An example (not related to hearing protection) is given to illustrate the scale for scoring.

2.2 Campaigns

Seven recent campaigns have been included in this study. They all address the potential risks of exposure to loud music, trying to motivate teenagers and/or adolescents to adopt a hearing-healthy lifestyle.

As expected, all campaigns are visible on the internet, using a website, social media, and most of the time combining both. The websites do vary between campaigns, some clearly designed to attract the population of teenagers and young adults, others presenting more factual information. One initiative addresses a broader audience, not only adolescents, but also teachers, and event organizers.

Apart from online information, most campaigns use other ways of communication, such as posters and advertisement on radio. One campaign even presents a short movie about tinnitus.

All campaigns present factual information together with tips and tricks to prevent noise-induced hearing loss. Three campaigns also add some kind of online self-test, addressing the risk of hearing loss, and one offers an smartphone application to measure the environmental noise level.

Geographically, two campaigns are presented by the Flemish government and as such cover the whole of Flanders. Four other campaigns are more regional, each of them addressing one particular Flemish province. Finally, one campaign is made by one of the major health insurance organizations.

2.3 Participants

Participants are selected from students in the first or second year of university, the majority of these students is between 18 and 20 years old. Three different disciplines have been included; bachelor of science in bioscience engineering, bachelor of science in psychology, and bachelor of science in logopaedic and audiological sciences.

The questionnaires have been distributed on paper at the beginning of several lectures. All lectures took place in the first weeks of the academic year. The students were invited to complete the questionnaire during the break and to hand them in at the end of the lecture. Every participant received immediately a pair of foam earplugs as a reward.

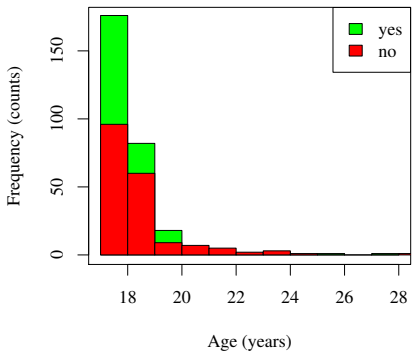
3 Results

From the 477 participants, 60.6 % had already heard of at least one campaign addressing hearing protection. The possible underlying variables for familiarity with campaigns accounted for in the current study are age, gender and study field.

With respect to age, little effect is expected to be seen as participants have been recruited in the first and second year of university, hence the majority of the data is concentrated between 18 and 19 years. Nevertheless, in this data set the 'older' students (over 20) seem to be more unfamiliar with the campaigns (Figure 1). Dividing the dataset in participants over 20 versus 20 years old or younger reveals that in the group over 20 only 32.1 % has heard about the campaigns, compared to 62.6 % in the other group. This difference is significant (χ^2 test $p < 0.01$).

In the group of 20 or younger, the familiarity with campaigns does not depend on study field (psychology, engineering or speech therapy; χ^2 test $p > 0.1$) or on gender (χ^2 test $p > 0.1$). For the total test sample, in psychology slightly more participants are unfamiliar with the campaigns compared to engineering and speech therapy (χ^2 test $0.01 < p < 0.05$). However, this is most likely due to the age effect reported above. In the current dataset, psychology has a clearly higher percentage of students over 20 than the other two disciplines (χ^2 test $p < 0.0001$).

With respect to the different campaigns, one campaign clearly stands out with 43.8 % of the participants having heard of it. This campaign was launched in 2012 by the Flemish government and is still maintained today with links to social media, an on-line self-test assessing the risk of hearing loss and a smart phone application to measure personal noise dose. In addition, a short movie 'Noise' ('Ruis' in Dutch) has been broadcast linked to this campaign. The other campaigns have reached far less participants, around 10 % or even below 5 %. This can be (partially) explained by the geographical covering of the campaigns, five campaigns have been launched by the five different provinces of Flanders and hence are not expected to be known outside this area. Another campaign has been launched by one of the three major health insurance organizations and has reached 7.34 % of the respondents. Again, this campaign is expected to addresses a specific part of the test group, namely the members of this particular health insurance. However, there is another campaign also launched by the



Figuur 1: Histogram of the participants' age is a function of familiarity with campaigns addressing hearing conservation (yes or no).

Flemish government in 2011, only known by 3.35 % of and despite its general distribution. This campaign is somewhat older, but at the time it was targeting the youth between 14 and 18 years old, matching exactly the population under study.

With respect to knowledge, answers to nine factual questions are compared for the group not familiar with any campaign and those who have at least heard of one. The question address broad hands-on knowledge concerning the prevention of noise-induced hearing loss due to music exposure. In general, the difference in factual knowledge between both groups appears to be limited, if any.

An encouraging finding is that a vast majority (over 90 % in both groups) knows that repeated exposure to loud noise does not protect from further noise-induced damage. In addition, over 80 % in both groups cites either 12 hours or 24 hours as an advisable rest period in-between exposure. It should be noted that both figures (12 as well as 24) are mentioned throughout the different campaigns.

By contrast, none of the groups seems very aware of the danger of combined effects. In both groups more than 50 % believes that smoking has no influence on the risk of noise-induced hearing loss. For alcohol, more than 40 % thinks that alcohol has no influence, and about one-third assumes that alcohol might actually help to prevent hearing damage. Furthermore, only one-fourth of the participants in both groups manages to estimate the safe exposure duration for a given noise level.

A slight difference in responses as a function of (un)familiarity with campaigns is found for identifying potential risky situation based on the necessity to raise their voice. In the group familiar with campaigns, only 6.62 % of the participants fasly thinks that the need to shout at 0.5 m does not imply elevated exposure levels. In the group unfamiliar with campaigns, this is 13.9 %. This difference is far from overwhelming, but marginally statistically significantly (χ^2 test $0.05 < p < 0.1$). Finally, in both groups more than half of the participants know that acquired noise-induced hearing loss is permanent, but in the group unfamiliar with campaigns 41.2 % believes that hearing damage only becomes permanent after continuing exposure, whereas this is 31.4 % in the group familiar with campaigns. This difference is again marginally statistically significant (χ^2 test $0.05 < p < 0.1$).

Taking measures to protect hearing is in general not very differently reported for

participants familiar with campaigns and those who are not. The use of measures has been assessed on a ten-point scale where participants had to indicate the percentage of the time they actually applied a certain measure. The most popular actions are relatively feasible ways of lowering music exposure, such as lowering the volume of their personal music player (median reported time applied of 70 %), moving a bit further away from the loudspeakers (median reported time 60 %), or taking a break in a more quiet environment (median reported time 60 %). Contrary, checking the noise level themselves is rarely reported; 10 % of the time (median) in the group familiar with the campaigns and 0 % in the other group. Comparing the rating (ordinal scale) between the two groups showed no significant difference for any of the above measures(Wilcoxon test $\alpha = 0.05$).

The use of hearing protectors as such is also not extremely popular, but here a significant difference is found. Participant who are familiar with campaigns report a higher use rate than participants who are not (median 40 % of the time versus 30 %; Wilcoxon test $0.05 < p < 0.1$).

4 Discussion

When discussing the risks of noise-induced hearing loss (NIHL), the most obvious solution lies in an overall reduction of the noise levels. In this regard, the Flemish government has taken action by imposing exposure limits of electronically amplified music [2]. However, especially for leisure time exposure, there is not one single risk source. By contrast, part of the problem is the subsequent exposure to different sources, such as personal music players, computer games, music at concert halls, and so on. Hence, to protect the hearing of teenagers and (young) adults, correct attitudes and personal behavior remain crucial factors.

In an unsupervised context – which applies for most leisure time conditions – correct information and knowledge are necessary, although not sufficient, for correct behavior. Educational campaigns can provide the necessary information. [6] point out that campaigns should not only provide factual information, but also focus on personal factors such as individual susceptibility. Several campaigns in this study provide indeed self tests assessing the risk of NIHL.

The campaigns included here are all launched broadly, addressing the public via website and/or social media. The first question with this kind of strategy is whether the campaigns are actually noticed by their target audience. In this study, 60.6 % of the respondents have heard of at least one campaign. This figure is clearly higher than what was found in previous work [5], but it also means that still a substantial part does not recall any of the campaigns. The participants here are all university students, so there is little reason to believe that the rates of people familiar with campaigns would be higher in a more diverse population.

Comparing the awareness between the different campaigns is difficult because of their differences in geographical target. Nevertheless, the most known campaign launched by the Flemish government is also the campaign that has been launched in a broader framework – i.e. the new legislation about electronically amplified music [2] – and uses the most multi-medial approach, with not only online material, but also a short movie and smartphone applications for noise level monitoring.

The results on factual knowledge are somewhat mixed. Some facts are clearly generally known – such as the fact that repeated exposure does not protect against further development of NIHL – but others are less clear, for instance the risks of combined

exposure of noise and alcohol or smoking. The latter facts are explicitly covered by most of the campaigns, but even the group familiar with the campaigns scores low here. For risk assessment of environmental noise levels, results are slightly but significantly better in the group familiar with campaigns, but here as well there is still clearly room for improvement.

The reported behavior to reduce noise exposure are encouraging. Actions to reduce the exposure such as moving away from the loudspeakers or taking a break in more quiet area are frequently reported. Moreover, in 2009 [10] has found that experts deemed these actions as effective, but unlikely to be actually done by adolescents. For the use of personal hearing protectors, a slightly positive effects of the campaigns is seen. [5] also reported a higher (reported) rate of usage after launching one particular campaign. However, the figures of reported usage found here and in previous work [5] remain quite low to fully count on personal hearing protection as measure to prevent NIHL in a leisure time context.

Referenties

[1] PM Arezes and AS Miguel. Hearing protectors acceptability in noisy environments. *Ann. Occup. Hyg.*, 46(6):531, 2002.

[2] B.S.29/03/2012. *Besluit van de Vlaamse Regering tot wijziging van het besluit van de Vlaamse Regering van 12 december 2008 tot uitvoering van titel XVI van het decreet van 5 april 1995 houdende algemene bepalingen inzake milieubeleid, wat betreft het maximaal geluidsniveau van muziek in inrichtingen. (Decision of the Flemish Government to change the decision of the Flemish Government of december 12, 2008 to apply title XVI of the decree of april 5, 1995 concerning the maximal soud level of music at venues)*. Published: Staatsblad.

[3] Jeannie H Chung, Catherine M Des Roches, John Meunier, and Roland D Eavey. Evaluation of noise-induced hearing loss in young people using a web-based survey technique. *Pediatrics*, 115(4):861–867, 2005.

[4] Shawna M Dell, Alice E Holmes, et al. The effect of a hearing conservation program on adolescents' attitudes towards noise. *Noise and Health*, 14(56):39, 2012.

[5] Annick Gilles and Van de Heyning Paul. Effectiveness of a preventive campaign for noise-induced hearing damage in adolescents. *International Journal of Pediatric Otorhinolaryngology*, 78(4):604–609, April 2014.

[6] Megan Gilliver, Elizabeth Francis Beach, and Warwick Williams. Noise with attitude: Influences on young people's decisions to protect their hearing. *International Journal of Audiology*, 52(S1):S26–S32, 2013.

[7] Megan Gilliver, Elizabeth Francis Beach, and Warwick Williams. Changing beliefs about leisure noise: Using health promotion models to investigate young people's engagement with, and attitudes towards, hearing health. *International journal of audiology*, (0):1–9, 2014.

[8] H. Keppler, I Dhooge, and B Vinck. Hearing in young adult. part ii: The effects of recreational noise exposure. *Noise and Health*, submitted.

[9] Hannah Keppler. *Optimization of the diagnosis of noise-induced hearing loss with otoacoustic emissions*. PhD thesis, Ghent University. Faculty of Medicine and Health Sciences, 2010.

[10] I Vogel, J Brug, CPB Van der Ploeg, and H Raat. Prevention of adolescents' music-induced hearing loss due to discotheque attendance: a delphi study. *Health Education Research*, 24(6):1043–1050, 2009.

[11] Ineke Vogel, Hans Verschuure, Catharina PB van der Ploeg, Johannes Brug, and Hein Raat. Estimating adolescent risk for hearing loss based on data from a large school-based survey. *American journal of public health*, 100(6):1095–1100, 2010.

[12] Viktor Weichbold and Patrick Zorowka. Can a hearing education campaign for adolescents change their music listening behavior? *International Journal of Audiology*, 46(3):128–133, January 2007.

[13] Fei Zhao, Vinaya KC Manchaiah, David French, and Sharon M Price. Music exposure and hearing disorders: An overview. *Int. J. Audiol.*, 49(1):54–64, 2009.